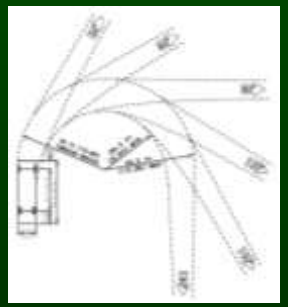
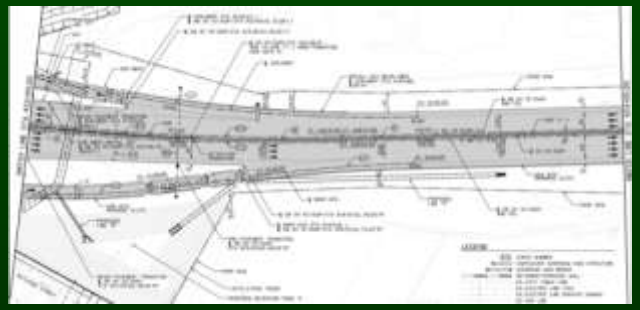
2011 AASHTO "Green Book" UPDATE

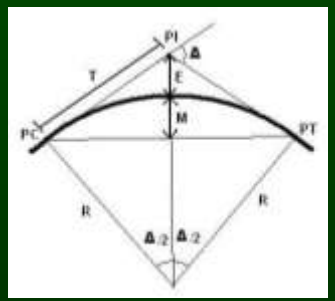
AASHTO Subcommittee on Design Annual Meeting
Portland, Maine

June 11, 2012

Jeff Jones, P.E., Chair, Technical Committee on Geometric Design
Marshall Elizer, P.E., APWA Representative to TCGD







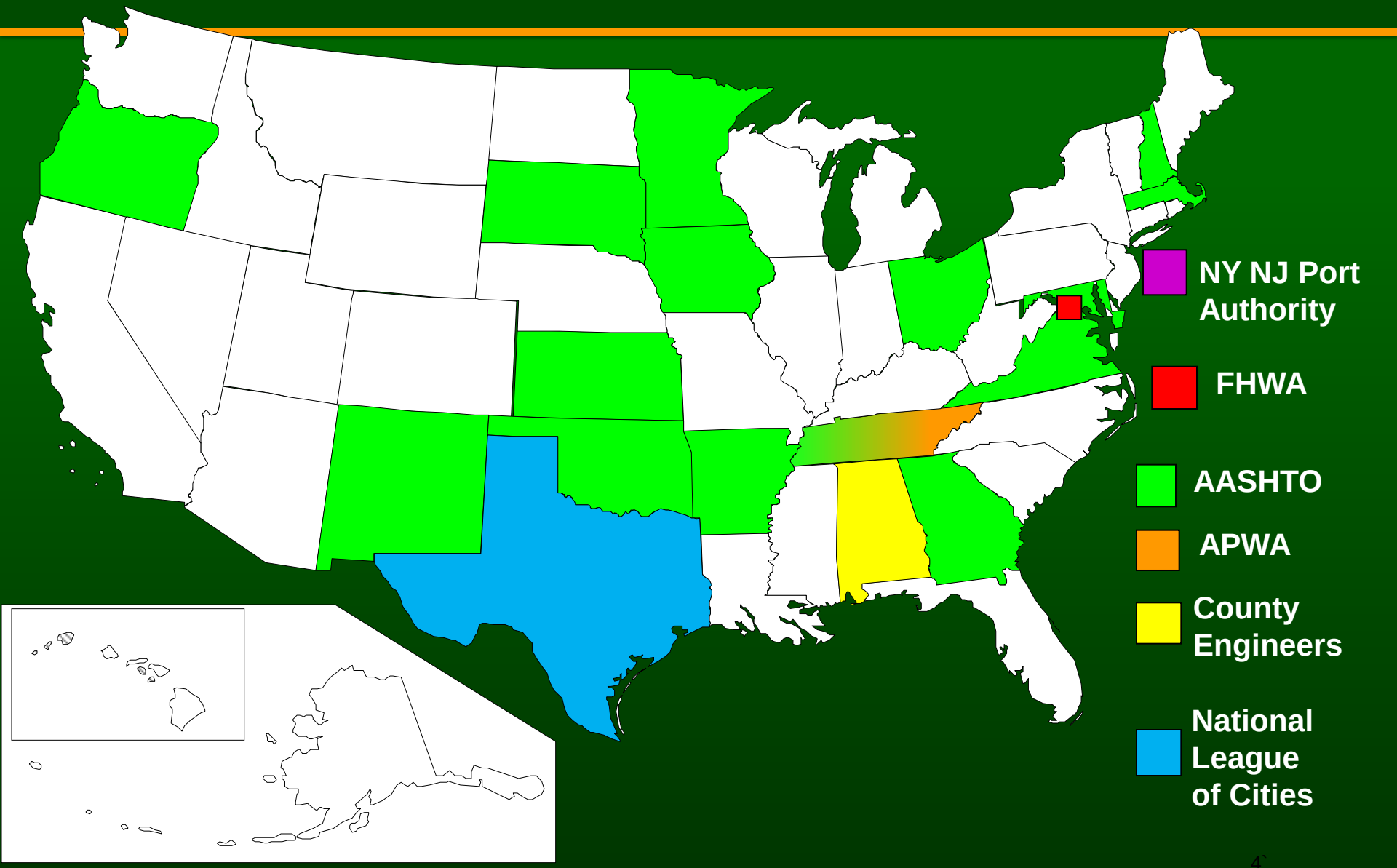
Session Outline

- The Technical Committee on Geometric Design
- What's changed in the 2011 Green Book
- Questions & Answers

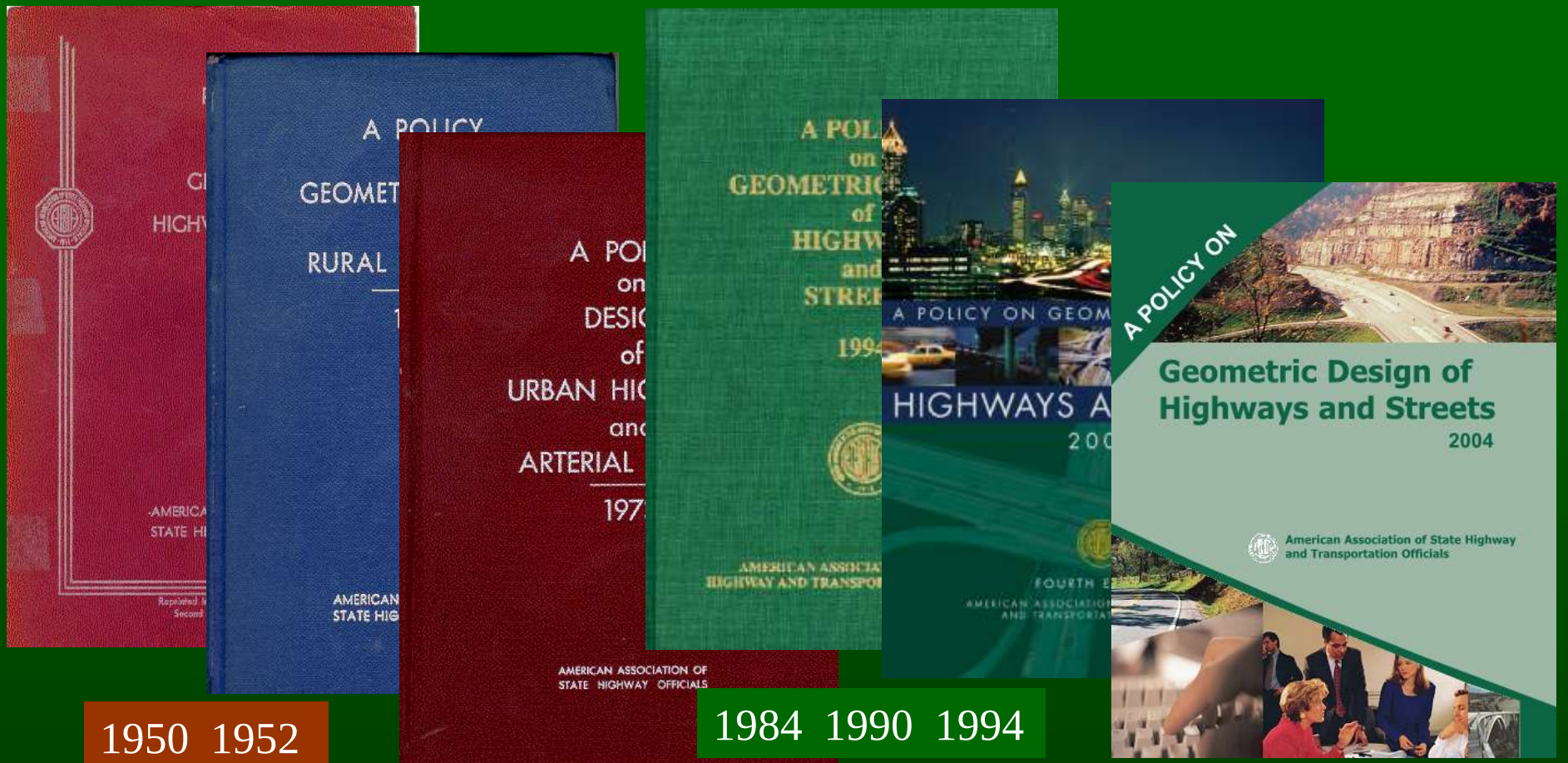
AASHTO Technical Committee on Geometric Design Members

- 18 State Departments of Transportation
- National Association of County Engineers
- National League of Cities
- American Public Works Association
- Port Authority of NY, NJ
- Federal Highway Administration

Technical Committee on Geometric Design



Previous Editions



1950 1952

1954 1965

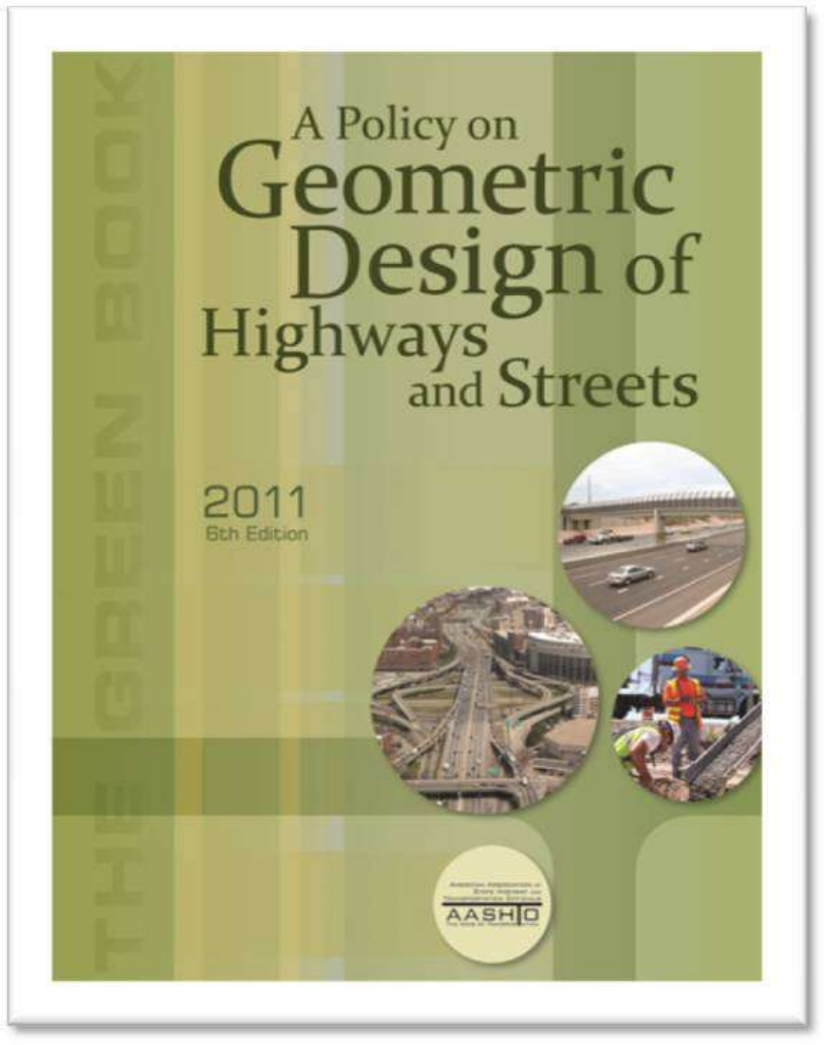
1957 1973

1984 1990 1994

2001

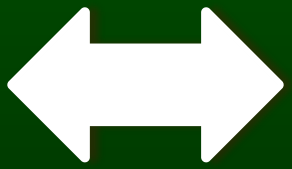
2004

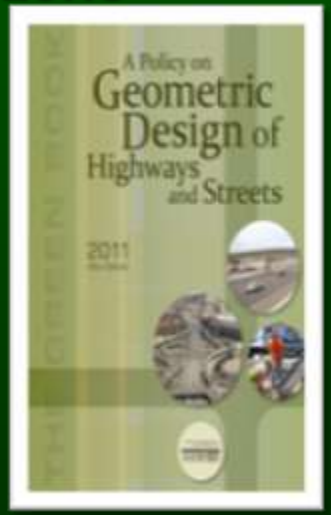
What's New in the 2011 Green Book?



2011 Green Book - General Changes

- NCHRP 20-07, Task 171: *Identification of Conflicts with AASHTO Publications Related to Clear Zone*
  - Inconsistencies between Green Book and the Roadside Design Guide, etc.
  - Definitions, terminology, policy
    - 'Horizontal Clearance to Obstruction' renamed to 'Lateral Offset to Obstruction'
    - 'Recovery area' replaced by 'clear zone'





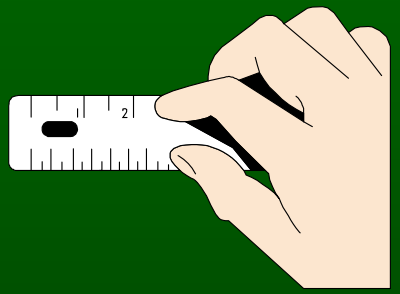
2011 Green Book – General Changes

- 'Must' or 'shall' only used in the case of a legal requirement
- 'Where possible' replaced by 'where practical' in most cases

  (Almost anything is possible)
- 'improves safety' or 'safe' replaced by 'reduces the frequency and severity of crashes' replaces
- Updated Photos

2011 Green Book - Format Changes

- Numbered sections and subsections
- Chapter-specific page #'s
  - e.g. Page 3-141
- Chapter #'s in the headers
- Chapters 5-8 organized consistently



2011 Green Book - Format Changes

- Electronic publication
  - Online download
  - Web-based
    - Lower price!

aashto.org
bookstore.transportation.org

The New Green Books Are Here!

Chapter 1 – Highway Functions

- Emphasis on designer consideration of the "context" of the project area [1.3.3 & 1.3.5]
- Highlights the flexibility available to encourage choosing design criteria: [pgs 1-9 thru 1-13]
  - Consistent with the context of the project
  - Needs and value of the community
  - With respect to economic limitations

Revised Functional Characteristics

- Rural: *"Minor arterials therefore constitute routes that should provide for relatively high travel speeds and minimum interference to through movement* ***consistent with the context of the project area and considering the range or variety of users***" [pg 1-9]

- Urban: *"For facilities within the subclass of other principal arterials in urban areas, mobility is often balanced against the need to provide direct access* ***as well as the need to accommodate pedestrians, bicyclists, and transit users***" [pg 1-11]

More on "Context" Sensitivity

- *"The first step in the design process is to define the function that the facility is to serve* ***and the context of the project area****" [pg 1-13]*
- *"…the designer should keep in mind the overall purpose that the street or highway is intended to serve,* ***as well as the context of the project area****" [pg 1-13]*
- *"Arterials are expected to provide a high degree of mobility for the longer trip length. Therefore, they should provide as high an operating speed and level of service* ***as practical within the context of the project area****" [pg 1-12]*

Multi-Modal Accommodation/Service

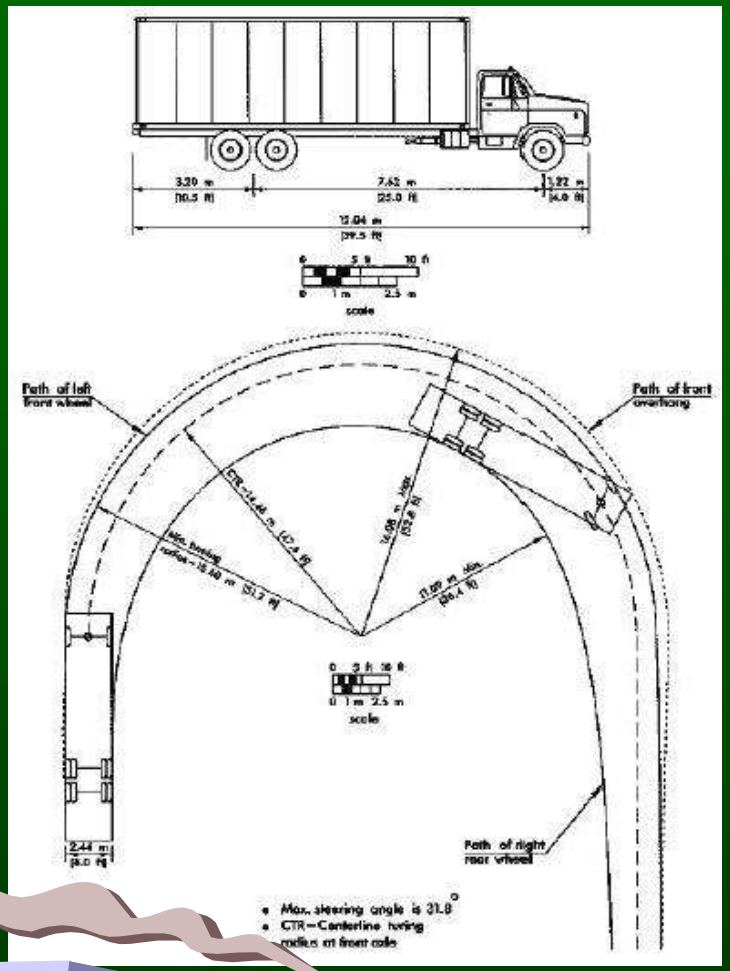
"Emphasis is placed on the joint use of transportation corridors by pedestrians, cyclists and public transit vehicles. Designers should recognize the implications of this sharing of the transportation corridors and are encouraged to consider not only vehicular movement, but also movement of people, distribution of goods, and provision of essential services. A more comprehensive transportation program is hereby emphasized."

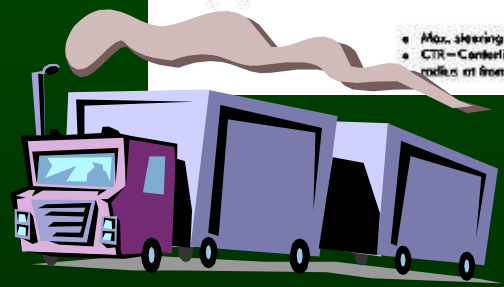
Green Book Foreword, pg xlii

Chapter 2 – Design Controls and Criteria

Design Vehicles*

- Added SU-40 single unit truck (3-axle) [pg 2-12]
- Removed WB-50 semitrailer truck and replaced with WB-62 [pg 2-23]
- Added WB-92B – Rocky Mountain Double [pg 2-26]





* NCHRP Report 505: *Review of Truck Characteristics as Factors In Roadway Design*

Design Speed

Selection of Design Speed:

- *"Above-minimum design values criteria for specific design elements should be used, where practical,* ***particularly on high-speed facilities. [pg 2-54]***

- ***On lower speed facilities, use of above-minimum design criteria may encourage travel at speeds higher than the design speed***." [pg 2-55]

The Pedestrian

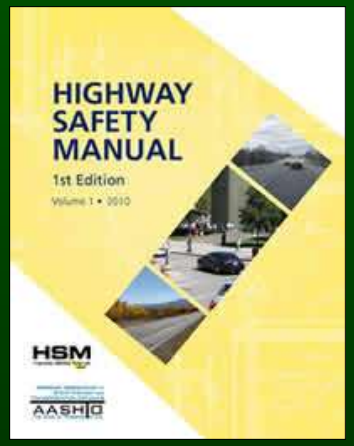
- Pedestrian walking speeds changed to be consistent with the MUTCD [pgs 2-79,80]
  - 3.5 ft/sec for pedestrian clearance (don't walk)
  - Total pedestrian crossing time based on 3.0 ft/sec
- References added to the PROWAG [pgs 2-78, 2-81]

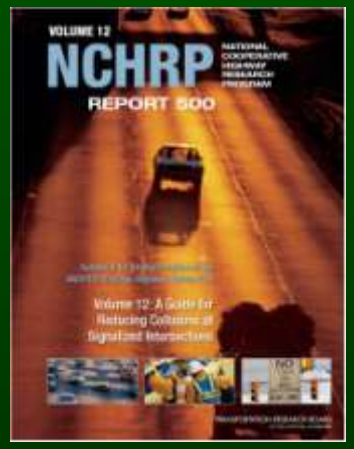
Traffic Operations

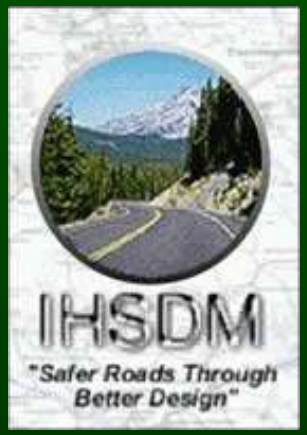
- "Principles for Acceptable Degrees of Congestion" content removed [pg 2-60]
- Now referenced to the TRB *Highway Capacity Manual*
- Multi-modal levels of service in HCM 2010
- Consideration for higher truck power-to-weight ratios and speed profile calculation [pg 3-114]

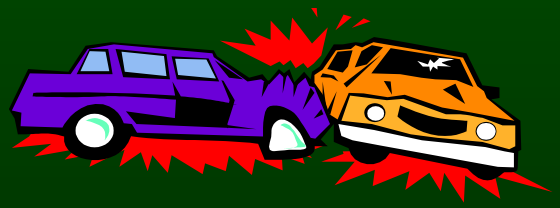
Safety

- References to “Safety” are commonly changed to “crash frequency and severity”
- Updated safety resources added references to the AASHTO **Highway Safety Manual**, the NCHRP Report 500 series, and the IHSDM [pg 2-85]



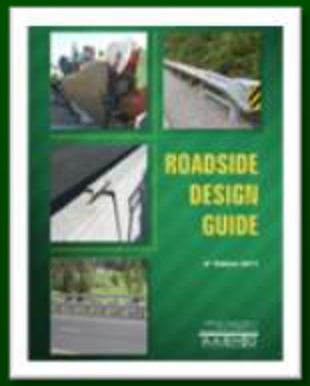


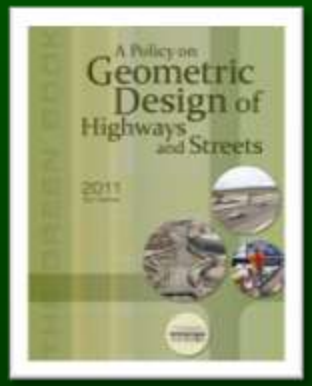




Clear Zone

- NCHRP 20-07, Task 171: *Identification of Conflicts with AASHTO Publications Related to Clear Zone*
  - Inconsistencies between Green Book, RDG, etc.





Level of Service

Functional Class	2004 Green Book Urban & Suburban LOS	2011 Green Book Urban & Suburban LOS
Freeway	C	C or D
Arterial	C	C or D
Collector	D	D
Local	D	D

Travel Lane Width (urban arterial)

- “Lane widths may vary from 10 to 12 ft..... Lane widths of 10 ft..... may be used in highly restricted more constrained areas where truck and bus volumes are relatively low and speeds are less than 35 mph having little or no truck traffic.
- Lane widths of 11 ft..... are used quite extensively for urban arterial street designs.
- The 12-ft lane widths are most desirable and should be used, where practical, on higher speed, free-flowing, principal arterials.”

Parking Lane Width (Urban Arterial)

2004 Green Book:

"Passenger vehicles parked adjacent to a curb will occupy, on the average, approximately 7 ft..... of street width. Therefore, the total parking lane width for passenger cars should be 10 to 12 ft....."

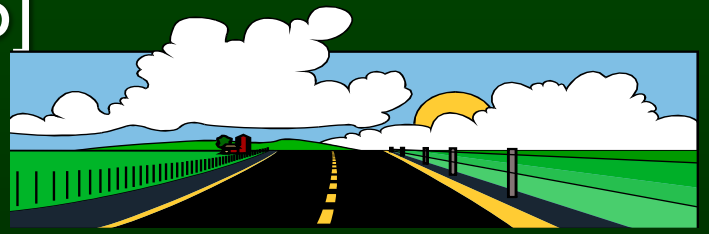
2011 Green Book:

"Passenger vehicles parked adjacent to a curb will occupy, on the average, approximately 7 ft..... of street width. Therefore, the total parking lane width for passenger cars should be 7 to 10 ft....."

Chapter 3 – Elements of Design

- Stopping Sight Distance tables clarified whether on level, wet weather, or grades [pgs 3-4, 3-5]
- Passing Sight Distance for Two-Lane Highways revised based on NCHRP Report 605* (now consistent with MUTCD) [pgs 3-8, 3-9]
- Enhanced height of object discussion in the criteria for measuring sight distance rather than in discussion of its need [pg 3-15]
- Optimal passing lane flow rates and design length values added [pg 3-135]

* NCHRP Report 605: *Passing Sight Distance for Two-Lane Highways*



Chapter 3 – Elements of Design

- 2+1 Roadways design guidance added based on NCHRP Research Digest 275 [pgs 3-132,135]
- Revised method for “Lane Drop Taper Length” for passing lane sections is consistent with MUTCD [pg 3-134]
- Design controls for crest vertical curves updated based on passing sight distance [3-157]
- Lighting – updated to conform to the AASHTO Roadway Lighting Guide and IESNA publications [3-172]
- Discussions of drainage, fencing and noise barriers moved to Chapter 4

Minimum Radii for Design Superelevation Rates, Design Speeds, and e_{max} = 8%

e (%)	V_d = 15 mph	V_d = 20 mph	V_d = 25 mph	V_d = 30 mph	V_d = 35 mph
	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)
1.5	932	1640	2370	3240	4260
2.0	676	1190	1720	2370	3120
2,2	605	1070	1550	2130	2800
2,4	546	959	1400	1930	2540
2,6	496	872	1280	1760	2320
2,8	453	796	1170	1610	2130

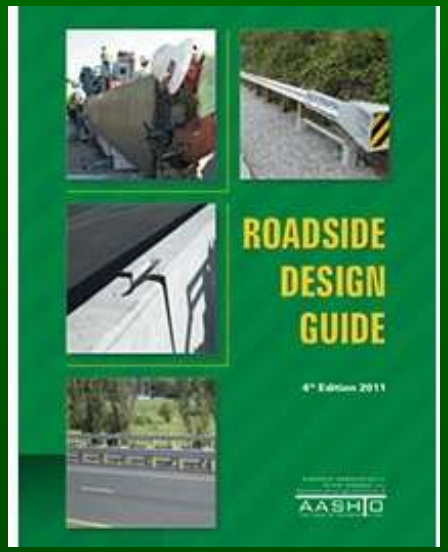
2004

e (%)	V_d = 15 mph	V_d = 20 mph	V_d = 25 mph	V_d = 30 mph	V_d = 35 mph
	R (ft)	R (ft)	R (ft)	R (ft)	R (ft)
NC	932	1640	2370	3240	4260
RC	676	1190	1720	2370	3120
2,2	605	1070	1550	2130	2800
2,4	546	959	1400	1930	2540
2,6	496	872	1280	1760	2320
2,8	453	796	1170	1610	2130

2011

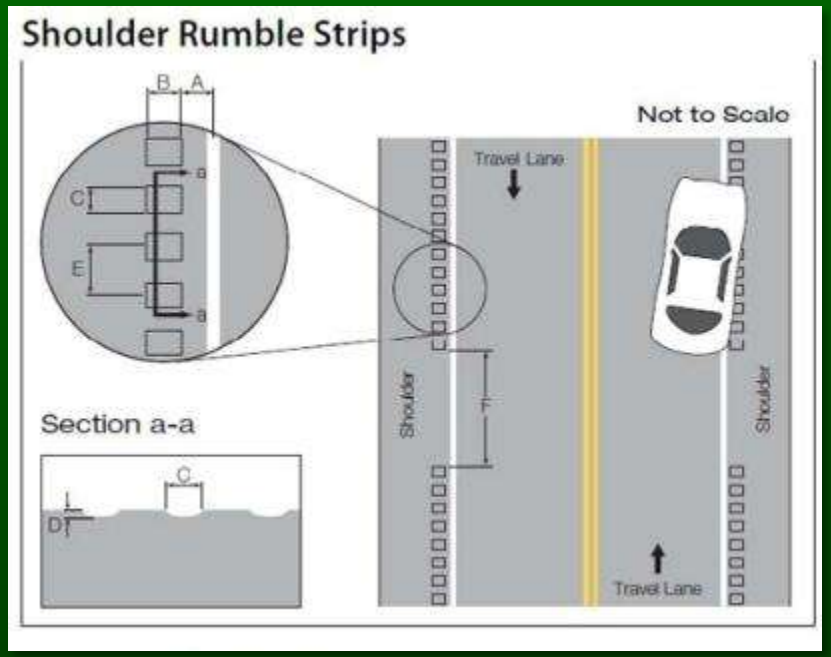
Chapter 4 – Cross Section Elements

- Traveled Way definition revised to be consistent with **Roadside Design Guide**, i.e., exclude shoulders/bicycle lanes [pg 4-1]
- Lane widths: “In urban areas where pedestrian crossings, right-of-way, or existing development become stringent controls on lane widths, the use of 3.3-m [11-ft] lanes may be appropriate.” [pg 4-7]



Chapter 4 Cross Section Elements

- Rumble Strip section added based on State experience and TRB/FHWA research (Section 4.5, pg. 4-14)



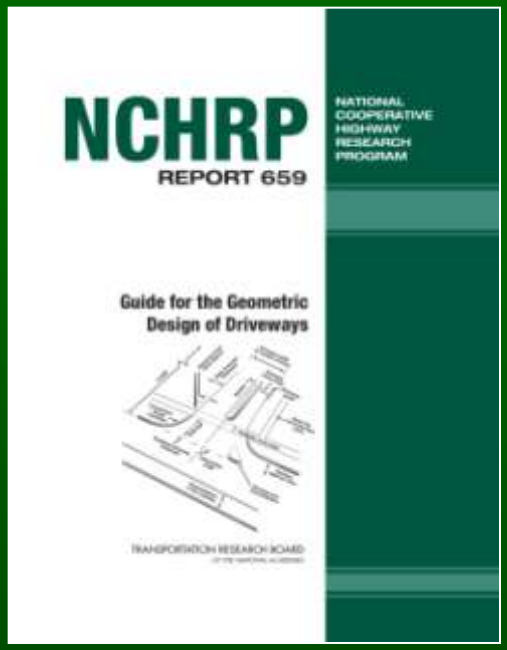
FHWA Technical Advisory T5040.35 Roadway Rumble Strips
NCHRP Report 641 - *Guidance for the Design and Application of Shoulder and Centerline Rumble Strips*

Chapter 4 – Cross Section Elements

- Clear zone and lateral offset discussion provided in a more consistent format with the **Roadside Design Guide** [pg 4-15]
- Curbs: for high-speed (≥ 50 mph) use sloping curbs; 4-in in rural or in urban/suburban areas with infrequent access points or streets, 6-in in urban/suburban areas with frequent access [pg 4-16]
- Sidewalks and Curb Ramps – updated discussion consistent with the AASHTO Pedestrian Guide and the PROWAG [pgs 4-57, 4-61]

Chapter 4 Cross Section Elements

- Discussion of driveway profiles to accommodate vehicle under-clearance, pedestrians, and drainage. References NCHRP Report 659 *Guide for Geometric Design of Driveways* [pg 4-48]
- Use of diagonal curb ramps discouraged [pg 4-62]
- Added discussion of on-street back-in, head-out diagonal parking [pg 4-72]

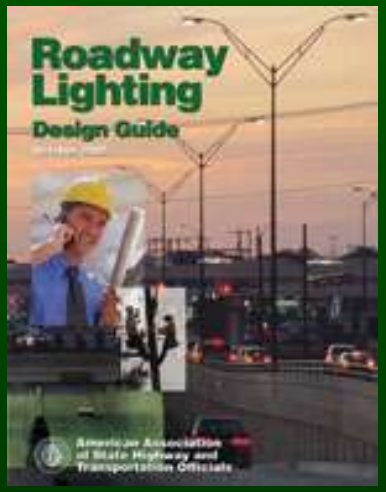


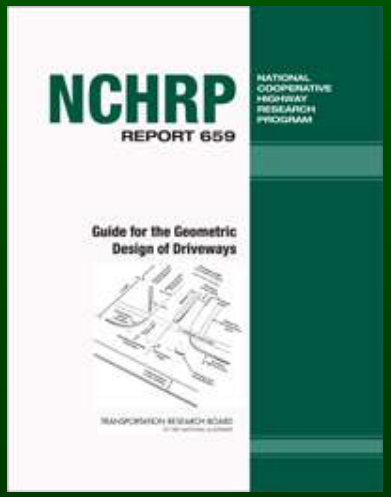
Chapter 5 – Local Roads and Streets

- Updated reference to AASHTO LRFD Bridge Design Specifications [pgs 5-7, 5-19]
- Clear zone and lateral offset discussion to be consistent with Roadside Design Guide [pgs 5-8, 5-20]
- Added discussion of Level of Service in Rural and Urban areas [pgs 5-3, 5-12]

Chapter 5 Local Roads and Streets

- Updated references to AASHTO *Roadway Lighting Design Guide* and ANSI/EISNA publications [pg 5-22]
- Added reference to NCHRP Report 659: *Guide for the Geometric Design of Driveways* [5-19]





Chapter 6 – Collector Roads and Streets

- Added discussion about selection of LOS for collectors [pg 6-12]
- Added roadside design discussion to clarify clear zone and lateral offset [pg 6-17]
- Pedestrian, bicycle and sign structures should provide 15 ft..... minimum vertical clearance [pg 6-17]

Chapter 7 – Arterials

Rural section additions:

- Added discussion about use of minimum radii and lengths of horizontal curves [pg 7-3]
- Medians: "…multilane undivided facilities should be discouraged except where provision of a median or turn lane is not practical" [pg 7-12]

Urban section additions:

- Characteristics: "The type of arterial selected is closely related to the level of service desired for all users and urban context in which it is located." [pg 7-26]
- LOS selections [pg 7-28]

Chapter 7 Arterials

Added discussion about:

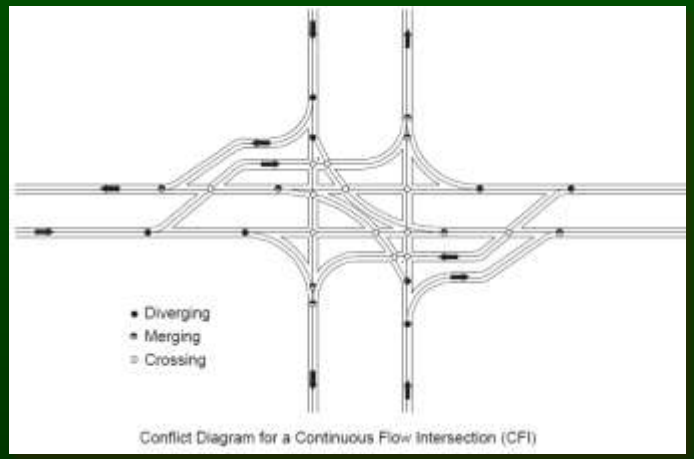
- Relationship between Design Speed and lane widths [10 ft..... < 35 mph] [7-29]
- Benefits of parking lanes [7-34]
- Benefits of medians to pedestrians in urban areas [7-31]
- Offset left turn lanes when selecting median widths [7-31]

Chapter 8 – Freeways

- Added discussion on superelevation rates considering snow/ice, viaducts, and section consistency [pg 8-3]
- Roadside Design: reorganized Clear Zone and Lateral Offset [pg 8-5]
- Shoulder width: where DDHV for truck traffic exceeds 250 veh/h, a paved shoulder width of 12 ft..... “should be considered” [previous “should be 12 ft.....’] [pg 8-3]

Chapter 9 – Intersections

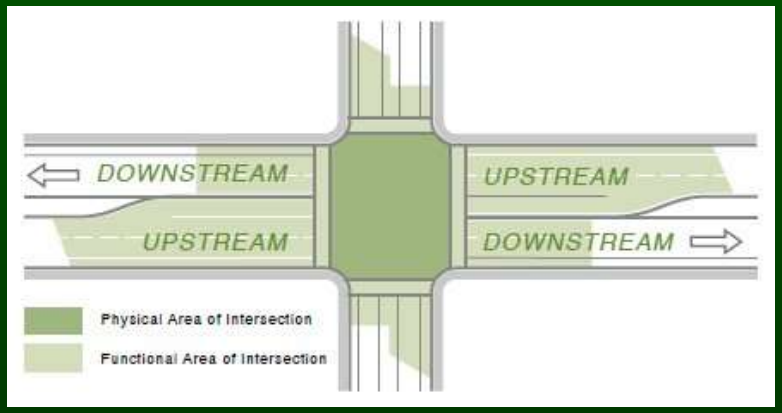
- Added or updated discussions of:
  - Intersection capacity based on HCM [pg 9-7]
  - Roundabouts [pgs 9-21, 9-167]
  - Continuous Flow Intersections [pg 9-160]
- Expanded discussion of Indirect Left Turns and U-turns [pg 9-162]

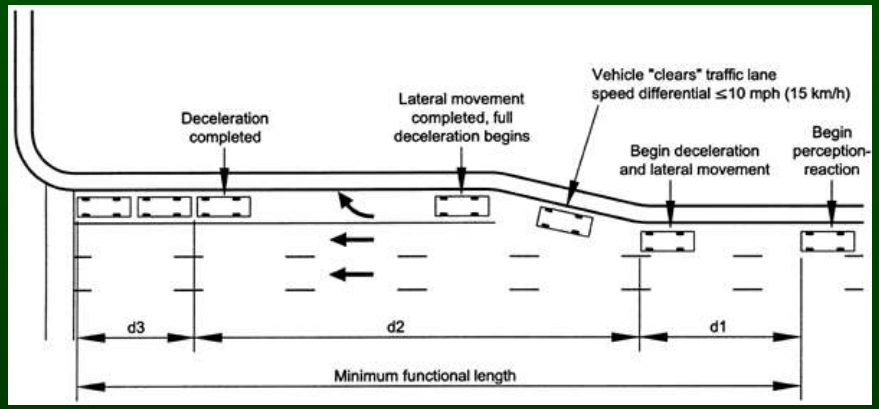


Conflict Diagram for a Continuous Flow Intersection (CFI)

Chapter 9 Intersections

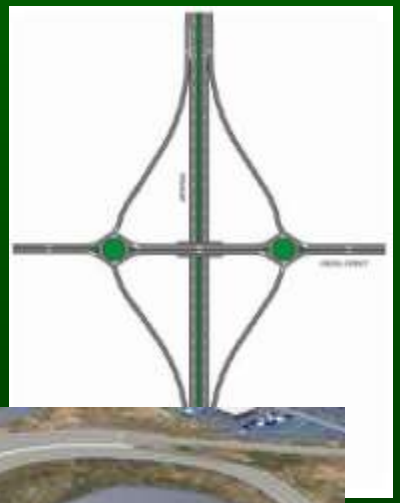
- Based on TRB Access Management Manual:
  - Definition of Functional Area [pg 9-2]
  - Components of Auxiliary Lanes [pg 9-124]
  - Deceleration Length Discussion [pg 9-126]
- Added design criteria for double/triple left turn lanes based on NCHRP 505 [pg 9-139]





Chapter 10 – Grade Separations and Interchanges

- Updated Exhibits and discussion for Directional/Semi-directional Interchanges
- Included an Exhibit for Diamond Interchange with Roundabout Intersection Control [10-42]
- Added discussion about:
  - Roundabout ramp terminals
  - Ramp metering [10-128]
  - Two-lane loop ramps [10-90]
  - Left-side ramp terminals [1-=103]
  - Vertical clearance above RR's [10-22]



Chapter 10
Grade Separations and Interchanges

- Terminology for Single-Point Diamond Interchange (SPDI) [previously SPUI] [10-42]
- Ramp shoulders and lateral offset: "The left and right shoulder widths may be reversed if needed to provide additional sight distance." [10-102]
- Procedure for measuring the distances between ramp terminals is given in the HCM 2010 new weaving methodology (measured between the painted noses) [10-106]

Questions?

Thank You

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